

0.05) reduction in feed intake of birds receiving CSL-E diet compared to CSL diet, indicating that β -mannanase supplementation in low protein and energy diets may increase the efficiency of protein and energy utilization in laying hens. However, there was no interaction of enzyme and feed at any stage of the study. There was no enzyme effect on egg production and egg to feed ratio between treatments. Birds receiving CSL and CSL-E diets had lower ($p < 0.05$) egg shell thickness compared to birds receiving CS and CS-E; however, there was no enzyme effect at both nutrient levels. No significance differences were observed between treatments for specific gravity, shell breakage strength, and albumin height of eggs. β -mannanase supplementation in low protein and energy diets may improve nutrient utilization in laying hens, however, it may not have significant effects on egg production and egg quality parameters of laying hens.

Key Words: β -mannanase, laying hens, nutrient utilization, egg quality

M70 Effect of β -mannanase on growth performance, ileal digestible energy, and intestinal viscosity of male broilers fed a reduced energy diet Rocky Latham^{*SCI}, Mallori Williams¹, Kyle Smith¹, Kendre Stringfellow², Roy Brister³, Sergio Clemente², Jason Lee¹ ¹Texas A&M University, College Station, TX; ²Novus International, Inc., St. Charles, MO; ³Tyson Foods, Springdale, AR

An experiment was conducted to investigate the effect of β -mannanase (Cibenza® DE200) on male broiler growth performance, energy digestibility, and intestinal viscosity in reduced energy diets. A randomized complete block designed study included three treatment groups with 15 replicates of 40 male broilers per replicate for a 49 day experiment for a total placement of 1,800 broilers. The three dietary treatments included a positive control (PC) diet, a negative control (NC) diet (-97 kcal/kg in AME), and NC + β -mannanase (400,000 U/kg). Broilers were fed a starter (0.45 kg/bird), finisher (1.80 kg/bird), and withdrawal (remainder of growout). Growth performance was monitored on a weekly basis and ileal contents collected on day 17 and 37 days of age to determine ileal digestible energy and intestinal viscosity. Titanium dioxide was used as an indigestible marker for the determination of ileal digestible energy. Ileal contents were centrifuged and the supernatant collected for viscosity determination using a Brookfield Cone and Plate Viscometer. The PC treatment maintained significantly higher average body weight when as compared to the NC diet through 42 d of age indicating that the reduction in energy was sufficient to reduce body weight. The inclusion of β -mannanase achieved similar performance to the PC through d 42. Reduction in dietary AME increased cumulative mortality corrected FCR in

the NC diet as compared to the PC throughout the experiment. Inclusion of β -mannanase significantly improved FCR as compared to the NC diet throughout the experiment. No differences were observed in intestinal viscosity. Improved FCR could be attributed to a 55 kcal/kg observed increase in digestible energy as compared to the NC diet at 17 days of age. The inclusion of β -mannanase improves body weight and FCR of broilers when fed reduced energy diets.

Key Words: Broiler Performance, Ileal Digestible Energy, DDGS

M71(1) Effects of a mannose rich fraction on fat pad and energy digestibility of first-cycle laying hens fed various concentrations of dietary energy Alysha Gareis^{*SCI}, Michael Persia¹, Paulo Rigolin² ¹Iowa State University, Ames, IA; ²Alltech, Inc., Nicholasville, KY

Energy has become an important aspect of poultry production as corn and feed oil have become linked to fuel markets. The objective of this experiment was to evaluate Actigen®, mannose rich fractions from the cell wall of a specific strain of yeast (MRF), on AMEn and body composition when supplemented to laying hen diets containing various dietary energy concentrations. The experiment was a 2 x 2 factorial, including diets supplemented with and without the MRF and two concentrations of dietary energy (2,850 kcal/kg or 2,750 kcal/kg). Each experimental unit (EU) consisted of one hen per cage (204 sq in²/bird) for a total of 12 EU for the 4 dietary treatments. Abdominal fat pad (AFP) weight is a cumulative measure so this experiment was set up for 8 wk to understand if a shorter term feeding experiment could be used when considering body composition. Egg production, egg weight, egg mass, and mortality were recorded daily while feed intake was determined weekly. Body weights were obtained at the beginning and conclusion of the experiment, and hens were euthanized for dual-energy x-ray absorptiometry (DXA) and AFP weight measurements. Data were analyzed using ANOVA with a 2x2 factorial arrangement. Student's T test was used to separate means if significance was detected. Factorial analysis resulted in a significant main effect of energy, but not MRF on the total g and % of fat mass in the hens as determined by DXA analysis. The same main effect of energy was observed for fat pad weight, but only as a trend ($P = 0.12$). Both MRF and energy resulted in main effects as high dietary energy and MRF both resulted in a significant increase in AMEn. Overall, the MRF treatment increased AMEn but the increased dietary energy did not appear to be stored as increased fat content of the hen.

Key Words: body composition, dietary energy, laying hen, mannose rich fraction

Environment Management II

M71(2) House Environmental Impact of Wood Pellet Burning Stoves J.B. Hess^{*}, K.S. Macklin, J.P. Blake *Poultry Science Department, Auburn University, Auburn, AL*

Broiler house environment is a crucial factor in bird health, productivity and ultimately in the profitability of growers and poultry integrators alike. Wood pellet burning furnaces (Lee Energy Solutions, Crossville, AL) were tested in paired broiler houses on four broiler farms during fall and winter growouts for two years to determine influences on house ammonia, moisture control and temperature. On each farm, a house using wood burning furnace technology was paired with another house on the farm using conventional propane heat. Prior to bird placement for each farm and each growout, two temperature/humidity probes (Omega Engineering, Stamford, CT) were placed in each test house in the brood chamber to collect daily temperature and humidity information (4 times daily for the entire growout). At 14 days of age, a farm visit was made to collect litter and air ammonia measurements, litter temperature and samples for litter moisture determination. Ammonia measurements were obtained us-

ing a closed container of specified dimension (53.34 x 39.37 x 12.7 cm) inverted over the litter bed and determined using a Drager CMS Analyzer equipped with a remote air sampling pump attached to a 30 cm sampling hose located in the top center of the inverted container. Litter ammonia levels (measured as the ammonia leaves the litter) were meaningfully reduced 80% of the time in houses burning wood pellets, with an average reduction of 15 ppm. **Brooding humidity levels, important in the maintenance of air quality and crucial in the control of litter moisture, were reduced 75% of the time with wood pellet use. Reductions averaged 8%, with 15% humidity reductions not uncommon during the most difficult portion of the winter season. Brooding temperatures were marginally increased 50% of the time by the pellet burning furnaces despite tight temperature control through house controllers.**

Key Words: Broiler, Ammonia, Humidity, Temperature, Wood Pellet Burning Stove

M72 Relationship of Hatch Time to Broiler Chick Percentage Yolk Sac and Subsequent Live Performance John Brake¹, Serdar Ozlu², Okan Elibo² ¹North Carolina State University, Raleigh, NC; ²University of Ankara, Ankara, Turkey

Broiler hatching eggs from broiler breeder flocks (Ross 344 X 308SF) at 59 and 55 wk of age were used in Experiments 1 and 2, respectively. Eggs were stored in a cooler for 1-3 d prior to setting in Petersime incubators under standard single-stage conditions. Early hatch time was 472-480 h or 471-477 h, Middle hatch time was 488-492 h or 480-486 h, and Late hatch time was 496-510 h or 494-510 h, respectively, in Experiments 1 or 2. Chicks were deemed to be hatched when they exhibited healed navels and dryness about the head and neck. At 510 h of incubation, hatched chicks were removed from the trays, feather sexed, counted, identified with neck tags, weighed, and placed in floor pens on new wood litter shavings. Chicks were necropsied and yolk sac weight determined at placement in pens and 24 h later (1 d) in Experiment 1 and immediately at each hatch time (477 h, 486 h, and 510 h) and also at placement in Experiment 2. For each hatch time, chicks were assigned to 8 pens of 10 male and 10 female chicks each or 9 pens of 9 male and 9 female chicks each for a total of 480 or 486 chicks in Experiments 1 and 2, respectively. BW and feed consumption were determined at 1, 7, 28, and 35 d of age or 7, 14, 21, and 35 d of age in Experiments 1 and 2, respectively. Mortality was noted daily. Data from the 3 (hatch time) x 2 (sex) completely randomized design were subjected to analysis of variance. Percentage yolk was greater in Late hatch compared to Early and Middle hatch chicks at placement and at 1 d in Experiment 1. Percentage yolk was similar in all groups in Experiment 2 at hatch time but Early hatch chicks exhibited less percentage yolk at placement. Chick BW was greater at placement in Late hatch chicks compared to Early hatch chicks in both experiments but this was no longer apparent by 7 d. BW was greater in the Middle hatch compared to Late hatch chicks with Early hatch chicks intermediate at 7 and 35 d in Experiment 1. Although Early and Middle hatch chicks exhibited greater BW loss between hatch and placement and lower BW at placement compared to Late hatch chicks, Early hatch chicks had significantly larger BW than Late hatch chicks with Middle hatch chicks intermediate at 35 d in Experiment 2. Late hatch chicks consumed less feed and exhibited lower relative growth rate to 7 d and exhibited greater cumulative mortality in both experiments. Late hatch chicks had greater percentage yolk sac and BW at 510 h of incubation, which was followed by reduced feed consumption to 7 d. Mortality and BW gain was also poorer in Late chicks relative to Early and Middle hatch chicks.

Key Words: broilers, hatch time, yolk sac, feed consumption, mortality

M73 Early application of a novel probiotic improves gut development in neonatal broiler chicks R.E. Wolfenden*, J.L. Vicente, J. Lum, M.F. Faulkner *Pacific Vet Group, Fayetteville, AR*

Early gut development in broiler chicks is stimulated by the establishment of healthy gut microflora. In nature, hens and the environment provide these microflora to chicks, however, in the hatchery setting chicks are separated from hens which slows the rate at which normal flora is established in the neonate. This retards intestinal development which in turn decreases market weight. The first organisms to colonize the GI tract have a distinct advantage in becoming the primary residents. However, the most common environmental bacteria in the hatchery and farms often include species which are pathogenic to poultry. Mounting evidence indicates that early treatment with probiotics provides an opportunity to colonize the GI tract of broiler chicks, to induce gut development, increase 7 day weight, as well as out-compete potential pathogens. In this study we used a novel, hatchery-applied probiotic, FloraStart™ (FS), which is comprised of *Lactobacillus plantarum* (TY036) and *Enterococcus faecium* (MFF109) to determine its effect on villus development and 7 day weight gain in broiler chicks. Chicks were treated with either 1X10⁶ MFF109 and TY036 or sterile saline and then placed into pens. After six hours, all groups were challenged

with *Salmonella* Enteritidis. At three days, villus length of FS treated birds was significantly greater from 255.8 ± 3.7 µm in controls as compared to 309.2 ± 1.5 µm in treated chicks (P < 0.01). To determine 7 day weight gain, chicks were weighed on day of hatch and on day 7. Average 7 day weight gain from the FS group was significantly greater at 108.0 ± 3.4 g as compared to 78.3 ± 4.7 g in the controls (P < 0.01). These results indicate that treatment with FloraStart provides a unique opportunity to colonize neonatal broilers with beneficial microbes that have multiple beneficial effects to include an increase in 7 day weight as well as early protection from pathogens.

Key Words: Probiotic, Gut Development, Salmonella Enteritidis, 7 Day Body Weights

M74 Antimicrobial Resistance in Aviary and Enriched Housing Environments Paula Fedorka-Cray¹, Deana Jones¹, Darrin Karcher² ¹USDA-ARS, Athens, GA; ²Michigan State University, Department of Animal Science, East Lansing, MI

Antimicrobial resistance continues to be a global problem. The purpose of this study was to elucidate the emergence of resistance in populations of bacteria over time in layers in different housing systems. Houses were newly constructed and tested for pathogens prior to placement of hens. Hens were placed in aviary or enriched systems and samples (feed, water, and environmental which consisted of multiple nest box, belt, scraper, and scratch pad swabs) were collected and cultured for *Salmonella* and *Escherichia coli* using standard laboratory methods. All isolates were tested for susceptibility to a panel of antimicrobials using the NARMS methods. Prior to placement of the birds only 2 feed samples were positive; both for *S. Mbandaka* and *E. coli*. Approximately 10 weeks later, 13/295 samples from the enriched system were positive for *S. Altona* or Kentucky while 2/99 from the aviary system were positive for *S. Altona*. Ten and 20 weeks later 11/123 and 14/122 from the enriched environment continued to be positive for either Altona or Kentucky while 1/25 at each sampling from the aviary system was positive for Altona. No *Salmonella* isolates were resistant to any antimicrobials tested. Both initial feed samples for *E. coli* were not resistant to any antimicrobials tested. At 10 weeks, 182/295 and 99/99 samples were positive for *E. coli* from the enriched and aviary systems, respectively. *E. coli* from the enriched system were susceptible to chloramphenicol, ciprofloxacin and kanamycin. At least 3 or more (range 3-28) isolates were resistant to all other antimicrobials tested including nalidixic acid (n=4). Conversely, from the aviary system, resistance was only observed to gentamicin, streptomycin, sulfisoxazole, tetracycline, and nalidixic acid; however, more isolates were resistant to these antimicrobials (range 6-36) and 26 isolates were resistant to nalidixic acid. The environment, but not the feed, was negative prior to placement of the hens. Mbandaka was only isolated from feed and not the environment. Kentucky has only been isolated from the enriched system. *E. coli* isolates from the aviary system are resistant to fewer antimicrobials but the prevalence of resistance is higher to some antimicrobials than those from the enriched system. This study shows a dynamic that has not been described previously. Additional collections will continue to elucidate the transmission of *Salmonella* as well as antimicrobial resistance attributes within a production system.

Key Words: aviary, enriched, Salmonella, E. coli, antimicrobial resistance

M75 Current status of Salmonella spp., isolated from laying hen farms in Tolima district, Colombia Noel Verjan-Garcia*, Roy Rodriguez, Clemencia Fandiño, Libia Guzmán, Ilang Rondón *Universidad del Tolima, Ibagué, Colombia*

Salmonellosis is a widespread major zoonotic disease caused by *Salmonella* spp. The bacterium is usually isolated from intensive livestock systems such as bovine, pigs and poultry. Chicken meat, eggs and poultry byproducts are the main source of transmission of *S. enteritidis* to humans due to the feasibility of cross-contamination in poultry processing plants. In addition, *Salmonella*-infected chickens and other birds can be asymptom-

atic and may not develop the disease and are regarded as natural carriers. Epidemiological studies on *Salmonella* spp. in poultry farms in Tolima district are very limited, and the prevalence, impact on bird's health status and public health is currently unknown. The objective of this study was to estimate the prevalence of *Salmonella* spp. in a target population of 45 laying hen farms in Tolima region, holding 1.9 Million egg-laying hens. To this purpose, a cross-sectional observational study was conducted on 15 egg-laying hen farms chosen by the investigator based on the owner's attitude to participate in the study. A total of 589 samples including cloacal swabs (155 pools), food (31), drinking water (31), eggs (310), drag swabs (31) and operator's stool samples (31) were collected from January to June 2013, and cultured for *Salmonella* isolation following standards microbiological test and characterized by conventional biochemical tests and serotyping. The prevalence for *Salmonella* spp. was found to be 33.3% in those farms and the bacteria was recovered from eggs shells, food and drag swabs but not from cloacal swabs. Molecular characterization by PFGE is in progress to establish the relationships between the *Salmonella* isolates. Finally, a survey was conducted to identify potential risk factors and found that farm's practices such as independent feed mill, egg packed on sampled site, and absence of microbiological analysis of birds and drinking water among others, were associated with the presence of this microorganism.

Key Words: *Salmonella* spp., laying hen flocks, prevalence

M76 Reducing ammonia concentration and emissions with frequent litter amendment application during grow-out Hong Li¹, Chongyang Lin¹, Stephen Collier² ¹University of Delaware, Newark, DE; ²University of Delaware, Georgetown, DE

Litter amendments have been used to control the ammonia (NH₃) emission from the broiler litter during the brooding period. One of commercially available litter amendments, sodium bisulfate, was frequently applied on the litter with two different rates on weekly base in a laboratory setup and with a single rate on bi-weekly base under field conditions. Repeated application of sodium bisulfate led to significant reduction in NH₃ emissions from broilers. The magnitude of NH₃ emission reduction increases with the application rate of sodium bisulfate. The reduction rates of cumulative emissions with 366 g/wk-m² (75 lb/wk-1000ft²) rate (from 14 to 64.5 %) were higher than the reduction rate of 183 g/wk-m² (37.5 lb/wk-1000ft²) rate (from 0 to 55 %) from 28- to 61-d of age. The cumulative NH₃ emission was reduced by 51.7% with 244 g/2wk-m² (50 lb/2wk1000ft²) rate over a three-flock period (8 week average grow-out per flock) under field

production conditions. Sodium bisulfate application showed no significant difference on body weight and feed conversion efficiency. However, foot pad quality was significantly improved by sodium bisulfate application. Litter pH and ammonia nitrogen level of the litter were decreased by sodium bisulfate application with both rates. Organic and total nitrogen contents in the litter were higher while less nitrogen was emitted as NH₃.

Key Words: ammonia, emission, broiler, grow-out, litter amendment

M77 Screening of bacteriocin-like compound synthesis (BLC) from *Bacillus* spp: relation of diet composition, viscosity and proliferation of *Clostridium perfringens* in an in vitro digestive model Guillermo Tellez^{*1}, Juan David Latorre¹, Ross Wolfenden², Jose Luis Vicente², Anita Menconi¹, Amanda Wolfenden¹, Lisa Bielke¹, Olivia Faulkner¹, Billy Hargis¹ ¹University of Arkansas, Fayetteville, AR; ²Pacific Vet Group-USA, Inc., Fayetteville, AR

Thirty-three *Bacillus* isolates from a partially-characterized library within our laboratory were tested for *in vitro* BLC activity against *S. Enteritidis*, *E. coli*, *C. perfringens*, and *C. difficile*. Antimicrobial activity of 7/33 of these selected *Bacillus* isolates against all of the target pathogens was observed, whereas 6/33 showed little or no antimicrobial activity against any of the target pathogens. Three of these 33 strains comprise the commercial DFM Sporulin[®], and this commercial combination was included at 10⁹ spores/g in 5 different soybean-based diets with: corn, wheat, rye, barley, or oat content variations (1: 3.2, w/v H₂O). After digestion (195m; 40 °C, with or without DFM) supernatant fluids were tested for viscosity and CP proliferation (5 supernatants with and without DFM addition). The supernatants+tryptic soy broth (TSB; 1:2), TSB only, or PBS only, all with the addition of thioglycolate (0.5 mg/mL) were individually spiked to an initial concentration of 3 x 10⁴ cfu/mL and incubated anaerobically (40 C; 24 h). A significant (P< 0.05) increase in both viscosity and CP proliferation was associated with supernatants from diets containing wheat, barley, rye or oats, but not corn, when compared with PBS or TSB groups. These results suggest that the non-starch polysaccharides (NSP) from non-corn-based diets can both enhance viscosity and CP growth. Remarkably, dietary inclusion of selected DFM candidates in NSP diets significantly reduced both viscosity and CP proliferation when compared with control diets without the DFM. These *in vitro* results are consistent with previous reports of reductions in experimental and field necrotic enteritis associated with this commercial DFM.

Key Words: *Bacillus*, DFM, bacteriocins, viscosity, *C. perfringens*